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ABSTRACT

The main objective of the Primary Education Project (PEP) is to develop an individualized early learning program to serve children from age three through the primary grades. The 1968-1969 school year represented the first year during which a formal PEP program was implemented. This report describes the results of this first year. The PEP early learning curriculum included the following areas: (1) beginning mathematics curriculum; (2) classification curriculum, which included skills in basic color, size, and shape discrimination; and (3) gross and fine motor skills curriculum. The effectiveness of PEP is indicated by the significant gains in I.Q. scores and achievement levels by both the PEP criterion-referenced tests and standardized tests. This report presents information on students' progress in cognitive learning only. However, PEP is attempting to create a total learning environment which will affect the growth of young children in both cognitive and psychological development. (Author/FL)

UNIVERSITY OF PITTSBURGH - LEARNING R & D CENTER

WORKING PAPER 57

PEP IN THE FRICK ELEMENTARY SCHOOL
INTERIM EVALUATION REPORT OF THE PRIMARY EDUCATION PROJECT
1968-1969

MARGARET C. WANG, LAUREN B. RESNICK, AND PATRICIA A. SCHUETZ

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by

Margaret C. Wang, Lauren B. Resnick, and Patricia A. Schuetz

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University of Pittsburgh

1970

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PEP in the Frick Elementary School
Interim Evaluation Report of the
Primary Education Project
1968-1969

Margaret C. Wang, Lauren B. Resnick, and Patricia A. Schuetz

Background of PEP

The Primary Education Project (PEP) is a joint undertaking of the University of Pittsburgh and the Pittsburgh Public Schools.[1] Within the University, the Learning Research and Development Center (LRDC) is responsible for research and development of the basic model, and the Department of Elementary Education is responsible for development of inservice and preservice teacher training programs geared to the special requirements of an individualized educational system.

The primary objective of PEP is to develop an individualized early learning program to serve children from age three through the primary grades. The Primary Education Project's individualized instructional model has been under development at Frick Elementary School in Pittsburgh since September 1967. Borrowing relevant procedures and methods

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[1]The project was partially supported by a grant from the General Learning Corporation (GLC) until June 30, 1969. Thus, during the period covered in this report, GLC was a partner with the Pittsburgh Public Schools and the University in PEP.

from the Individually Prescribed Instruction (IPI) Project,[2] the PEP research and development staff has been developing an individualized instructional model which includes detailed curriculum and classroom management procedures appropriate for young children. (For a detailed description of the PEP approach to curriculum design, see Resnick, 1968.[3])

The 1968-1969 school year represented the first year during which a formal PEP program was implemented. This paper reports on the results of that first year of implementation.

PEP Developmental School

Frick Elementary School, the developmental school for PEP, is a Pittsburgh public school situated near the University of Pittsburgh. All of the Frick students live in the inner-city neighborhood in which the school is located. The majority of students are from economically disadvantaged families, a large proportion of them living in public housing projects within walking distance of the school. A small percentage of the Frick students are children of university faculty, staff, graduate students, and other professional people.

During the 1968-1969 school year, the PEP program was formally instituted in all the prekindergarten (three- and four-year-olds) and kindergarten classes, and in the reading readiness class at Frick School. Table 1

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[2] Lindvall, C. M., & Bolvin, J. O. Programed instruction in the schools: An application of programing principles in "Individually Prescribed Instruction." In Sixty-Sixth Yearbook of the National Society for the Study of Education, Part II. Chicago: NSSE, 1967. (Reprint 16)

[3] Resnick, L. B. The design of an early learning curriculum. Pittsburgh: Learning Research and Development Center, 1968. (Working Paper 16)

summarizes the family background of the children who attended PEP classes during that year. As indicated in this table, the "typical" family in the population was black, with the father employed in a semi-skilled laborer's job. Twenty-seven percent of the children came from families with no father present. Table 2 lists age, sex, and mean IQ of the students who attended the PEP classes at Frick during the 1968-1969 school year.

The PEP teaching staff at Frick, during 1968-1969, consisted of six teachers, six assistant teachers, and one curriculum supervisor. PEP teachers reported a median age of 33 1/3 years and a median education of a Bachelor's degree plus 25 credits. Teachers had an average of 5.7 years of teaching experience, and each had a previous year working with the PEP research and development staff on the PEP curriculum. The six assistant teachers and aides had a median age of 40 years and a median education of 1.5 years of college. The average length of teaching experience for the assistant teachers at the conclusion of the 1968-1969 school year was 3.7 years; four of the six had completed a previous year working with the PEP program.

Student Achievement in the PEP Curriculum

The PEP early learning curriculum for 1968-1969 included the following areas: (1) beginning mathematics curriculum, which included quantification and measurement skills; (2) classification curriculum, which included skills in basic color, size, and shape discrimination; and (3) gross and fine motor skills curriculum. (See Appendix A for a detailed description of the learning objectives included in the PEP early learning curriculum.)

The battery of criterion-referenced diagnostic tests developed for PEP[4] was used to assess student achievement in the PEP curriculum. The diagnostic tests served both as achievement tests and diagnostic progress tests. They were used to determine whether or not a student had mastered the specified learning objective(s), and to provide a continuous account of the student's accomplishments, strengths, and weaknesses, so that teachers could prescribe learning activities that would be most effective in helping each student move forward in the curriculum continuum.

Table 3 reports the class summaries of student progress in the classification curriculum during the 1968-1969 school year. Column 1 of Table 3 lists five groups of children, prekindergarten through reading readiness. Columns 2 and 3 list the mean and standard deviation of the number of objectives passed on the pretest. These figures show the "entering level" of the group. Columns 4 and 5 show the mean and standard deviation of the number of objectives mastered by the end of the year.

As an example, group 1, the three-year-olds, had an average entering level of 7.13; this means that the average child in these classes had mastered something over seven objectives in the classification curriculum before any instruction was given. By the end of the year, the average number of objectives mastered by these children was 21.14.

To interpret the result in terms of the specific curriculum content, the mastery results indicate that, on the average, three-year-olds mastered two-thirds of the 33 instructional objectives included in the basic classification curriculum, which covers likenesses and differences, colors, sizes,

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[4] Wang, M. C. (Ed.) Criterion-referenced diagnostic tests: A teacher's manual, Primary Education Project. Pittsburgh: Learning Research and Development Center, University of Pittsburgh, 1968.

and shapes. Substantive achievement of the other classes can be interpreted in the same way. There is no significant difference in mean number of classification objectives learned by younger and older children. This reflects the prekindergartens' use of the basic classification objectives as a kind of "core curriculum" on which all children worked. However, the standard deviations are generally greater for the kindergarten and reading readiness groups. This reflects the ability of many of the older children to move on into the advanced classification curriculum, which stresses complex sorting and logical operations.

Appendix B includes some samples of student progress profiles depicting individual students' achievement in the classification curriculum. The ordinate of each graph indicates the student number; the abscissa indicates the number of objectives mastered. The portion of the bar with vertical lines indicates the entering level of the student; the black portion of the bar indicates the number of objectives he has worked on and achieved mastery of during the school year. The number at the end of each bar indicates the IQ score for that particular student.

Table 4 summarizes student progress of each group of children in the PEP quantification curriculum. Table 4 can be interpreted the same way as Table 3. The differences in the total number of quantification objectives mastered among children at different age levels are substantial. Substantively, most three-year-olds were able to count objects, while four-year-olds mastered both counting and reading and interpreting written numerals up to ten. The kindergarten and reading readiness children, on the average, had mastered the basic units and were working on counting and numerals from 1 to 20 as well as simple addition and subtraction problems when the year ended. These represent levels of achievement

substantially above those normally expected of kindergarten children. Some samples of student progress profiles depicting individual student progress in the quantification curriculum are included in Appendix C. Appendix C can be interpreted the same way as Appendix B.

Mastery and rate levels of the afternoon kindergarten children were lower than those of the morning classes. Afternoon children were, on the average, about six months younger than the morning children. In addition, the afternoon classes came to school only four days a week. This would slow down the rate of testing, although the total number of objectives learned was not seriously affected. The low mastery level for three-year-olds is a reflection of the fact that formal work in the quantification curriculum was not begun with these children until they were well adjusted to the school setting--for some children not until February.

Figures 1 and 2 summarize student progress in the PEP quantification and classification curricula graphically. The mean entry and the mean mastery levels of each age group are represented on the graph by bars of different designs. For example, the mean entry and the mean mastery levels of the three-year-olds are depicted by solid black bars, while the mean entry and the mean mastery levels of the four-year-olds are depicted by bars with diagonal lines. Figures 1 and 2 show some very interesting results. In Figure 1, for example, the difference between the second bar, the mean mastery level of the three-year-olds at the end of the school year, and the third bar, the entry level of the four-year-olds at the beginning of the school year, is substantial; while the difference between the first bar and the third bar, which represents the difference between the mean entry levels of the three- and four-year-olds at the beginning of the school year, is very small.

These differences are found consistently between the mastery level of any given age group and the entering level of the adjacent age group. Note in Figure 1, for the classification curriculum, the mastery level of the three-year-olds was even substantially higher than the entering level of the reading readiness group.

Performance on Standardized Tests

Changes in IQ score

The Stanford-Binet Intelligence Test (L-M form) was administered to all four- and five-year-old children in the PEP classes in October 1968. The test was repeated for 59 randomly selected kindergarten children in May 1969 to obtain information about possible changes in IQ scores.

Table 5 summarizes the IQ gains between the fall and spring testings. The mean IQ gains are reported in quartiles in the frequency distribution for boys and girls included in the sample. Overall, there was a mean gain of 5.29 points between the fall and the spring testings. This difference, which is highly significant statistically ($p < .01$), indicates that the PEP program had a significant impact on the children's general intellectual performance. Children with lower initial IQ scores made greater gains than those with higher initial IQ scores. The gains may be partly the result of regression effect.[5] However, the fact that the greatest gains were made by children in the second quarter of the frequency distribution indicates that the gains

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[5] Regression effect can be observed in retest results. It is the phenomenon in which the initially low test scores tend to move up toward the mean while initially high scores tend to drop toward the mean. In other words, students with low pretest scores tend to gain in retest scores while students with high pretest scores tend to show a loss, independent of the treatment effect.

were not entirely due to regression effect. Boys in the second quarter gained an average of over 11 IQ points, and girls in the same quarter gained 10 points on the average. Figures 3 and 4 show these results graphically. The center line in each graph represents the fall scores obtained by the children; the bars extending above and below the line show the number of points gained or lost by each child in the spring testing. The students included in each graph are ranged in order from lowest to highest initial score. The fall IQ score of each individual student appears at the bottom of each chart. There were two cases that showed a substantial loss in IQ points--one in Figure 3 and one in Figure 4. We believe this is due to unreliable spring test results. In both cases, the Wide Range Achievement Test scores were quite high. The percentile rank for the boy was 99.3, and the girl had a percentile rank of 66. Furthermore, mastery levels in the PEP curriculum for both children were substantially above the average mastery levels of other children in the program.

Standardized achievement test results

Since standardized achievement tests are not regularly given to Pittsburgh school children below first grade, the Wide Range Achievement Test (WRAT) was administered to the PEP kindergarten classes and the reading readiness class in May 1969. All of the three Level 1 subtests of the WRAT were administered. Test results are reported in Table 6.

The reading subtest required recognizing and naming letters and recognizing words; the spelling subtest involved copying marks resembling letters, writing one's name, and writing single words to dictation; and the arithmetic subtest tested counting, reading numerals, solving oral problems, and performing written computations. Of the three subtests, only the arithmetic subtest was directly "taught for" in the PEP early learning curriculum, although some of the perceptual-motor work in PEP was relevant to the lower-level spelling tasks.

Figure 5 summarizes the class results on the Wide Range Achievement Test graphically. As expected, performance on the arithmetic subtest was superior to performance on the reading and the spelling subtests. On the average, PEP children were performing at the early first grade level in arithmetic, indicating that they learned well what they were taught. Reading scores, by contrast, were at a level lower than "normal" for the end of kindergarten (K8 would be just average for May of the kindergarten year). Since no reading was taught in the PEP kindergartens, these scores probably represent a good estimate of where these children would stand without a special intervention program (such as they had in arithmetic). Note that percentile rankings show that in reading these children fell well below the national average while they were comfortably above the average in math. Spelling performance was more variable, probably reflecting differential attention to the related perceptual-motor activities in different classrooms. Class profiles for each subtest can be found in Appendix D.

In subsequent years, PEP classrooms will begin work in reading and related language arts during the kindergarten year. At that time, scores on the reading subtests will probably rise substantially. The results for 1968-1969 on arithmetic, however, demonstrate clearly that children from lower socioeconomic backgrounds, as represented in the PEP classrooms, can learn school material effectively when taught in an intensive, individualized program.

Discussion

The significant gains in IQ scores and achievement levels as measured by both the PEP criterion-referenced tests and standardized tests

can be interpreted as an indication of the effectiveness of PEP in helping young children from inner-city neighborhoods acquire those prerequisite learning skills that are identified as essential for successful subsequent learning.

Although this interim evaluation report presents information only on students' progress in cognitive learning, the PEP program is not oriented solely toward the development of cognitive skills. Rather, PEP is trying to create a total learning environment effecting the growth of young children in all of its interrelated aspects, including both cognitive and psychosocial development. The PEP research and development staff is working on measures to assess student learning outcomes in the affective domain, as well as in other areas of conceptual development. Future reports, it is hoped, will include data on development in many more areas.

Longitudinal evaluation plans have been developed for assessing long-term effects of PEP on student learning outcomes. Comparison studies as well as longitudinal studies on student learning outcomes will be included in our future reports.

Table 1

Parental Background

Characteristics		Father*	Mother
Occupation			
1.	Executive and professional	2.8%	1.0%
2.	Managerial, proprietors of medium-sized businesses, and graduate students	9.0%	1.4%
3.	Minor professional and small independent businessmen	3.8%	2.4%
4.	Clerical, sales, and technicians	10.0%	3.18%
5.	Skilled labor and services	12.8%	.5%
6.	Semi-skilled labor	16.1%	5.17%
7.	Unskilled labor	11.4%	1.9%
8.	Unemployed	4.3%	68.13%
No information		28.0%	15.12%
Deceased		1.8%	
Education			
Mean years		12.5	11.7
Range		0-20	0-18
No information		28.0%	23.3%
Family Size			
Mean number of children		3.4	
Range		1-11	
No information		41.9%	
Race			
Black	73.7%		
White	23.4%		
Other	2.9%		

*66.4% report fathers living at home, 27.4% report fathers absent, and 6.2% give no information.

Table 2

Description of the 1968-1969 Student Population
In Each of the PEP Classrooms

Class	C.A. Sept. 1968 X	Sex M	Sex F	IQ * Relative Frequency -75	76-80	81-85	86-90	91-95	96-100	101-105	106-110	111-115	116-120	121-125	126+	Mean X
1	4.2	10	8	.00	.00	.06	.11	.06	.18	.23	.18	.06	.06	.00	.06	101.2
2	3.5	8	8													
3	4.4	11	8	.05	.00	.17	.05	.11	.28	.28	.00	.00	.05	.00	.00	95.8
4	3.4	12	6													
5	5.3	11	11	.00	.05	.18	.00	.18	.18	.27	.00	.09	.05	.00	.00	96.9
6	4.8	8	11	.00	.00	.00	.17	.22	.17	.17	.06	.00	.00	.11	.11	104.7
7	5.2	10	9	.05	.11	.28	.17	.06	.05	.06	.05	.06	.11	.00	.00	92.1
8	5.0	13	12	.00	.00	.00	.05	.36	.05	.18	.09	.09	.00	.09	.09	105.2
9	5.3	13	11	.04	.19	.19	.23	.04	.14	.14	.00	.04	.00	.00	.00	89.1
10	5.0	9	9	.00	.00	.07	.40	.07	.27	.20	.00	.00	.00	.00	.00	94.1
11	6.5	6	10	.27	.13	.00	.20	.20	.13	.07	.00	.00	.00	.00	.00	85.5

*Obtained from the Stanford-Binet Intelligence Test, Form L-M, October 1968.

Table 3

Summary of Student Progress in the
PEP Classification Curriculum
(1968-1969 School Year)

Group	Entering Level*		Mastery Level**	
	Mean	S. D.	Mean	S. D.
Three-year-olds	7.13	17.5	21.14	9.4
Four-year-olds	11.89	16.4	24.56	7.2
Kindergarten--AM	10.07	27.0	27.86	14.9
Kindergarten--PM	7.13	23.8	23.36	12.8
Six-year-olds--Reading Readiness	9.00	22.9	24.63	14.6

*Number of objectives mastered before instruction.
**Number of objectives mastered from September 1968 to June 1969.

Table 4

Summary of Student Progress in the
PEP Quantification Curriculum
(1968-1969 School Year)

Group	Entering Level*		Mastery Level**	
	Mean	S. D.	Mean	S. D.
Three-year-olds	.22	7.8	6.76	10.1
Four-year-olds	1.75	11.8	16.78	7.9
Kindergarten--AM	5.72	13.2	30.01	19.4
Kindergarten--PM	4.60	25.0	26.22	17.2
Six-year-olds--Reading Readiness	6.25	22.5	27.63	10.5

*Number of objectives mastered before instruction.
**Number of objectives mastered from September 1968 to June 1969.

Table 5

Changes in IQ Test Performance for a Sample of Kindergarten Children Between October 1968 and May 1969 (N=59)

	Boys			Girls		
Distribution	N	IQ Range Fall Testing	Mean Gain	N	IQ Range Fall Testing	Mean Gain
1st Quarter	7	78-87	8.29	8	76-85	6.00
2nd Quarter	7	88-95	11.29	8	87-91	10.00
3rd Quarter	7	95-102	6.00	8	92-97	4.75
4th Quarter	6	110-166	-5.67	8	98-132	4.38

Table 6

Wide Range Achievement Test Results
(Grade Equivalent)
May 1969

Class	N	Subtest								
		Reading			Spelling			Arithmetic		
		Median	Range	%tile	Median	Range	%tile	Median	Range	%tile
K (5 yr. old)	20	K*5**	N8-1*.6**	27	K9	K1-1.4	53	1.6	K5-2.8	91
K (5 yr. old)	20	K4	PK2-5.9	23	1.0	PK2-1.8	61	1.2	PK8-2.1	73
K (5 yr. old)	23	K6	K2-1.3	34	K7	PK7-1.4	50	1.0	PK4-1.8	61
K (5 yr. old)	20	K8	K2-1.4	47	1.0	K1-1.3	61	1.0	PK4-1.8	61
K (5 yr. old)	20	K6	PK5-1.3	34	K4	PK3-1.3	25	1.0	PK4-1.8	61
K (5 yr. old)	17	K5	PK9-1.3	27	K5	PK1-1.2	27	K6	PK6-1.6	45
Reading Readiness (6 yr. old)	14	K9	K1-1.3	34	1.1	K4-1.7	68	1.3	PK8-2.2	58

Note: *Year
N = Nursery
PK = Prekindergarten
K = Kindergarten
1 = First grade
**Month

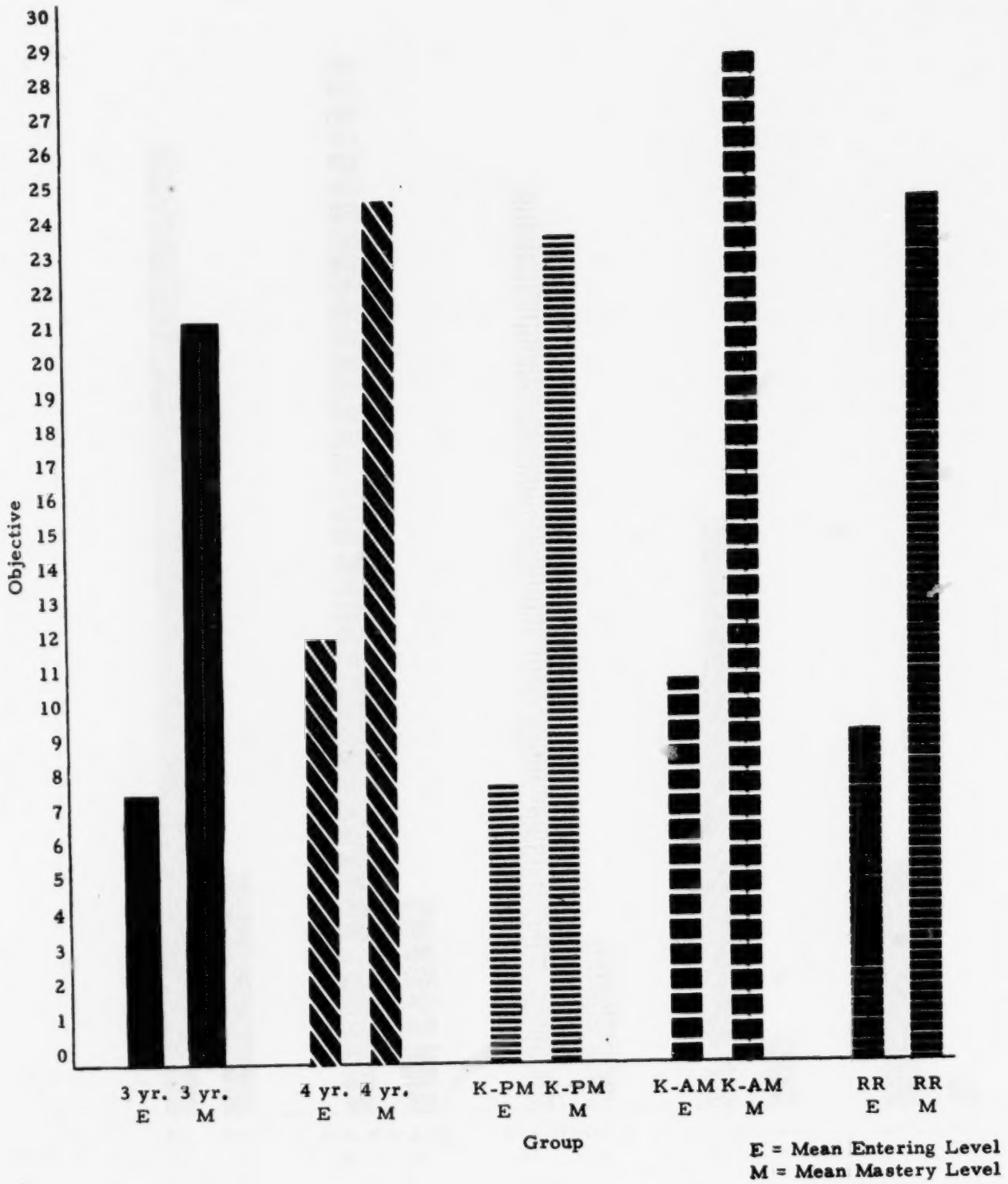


Figure 1. Student Progress in the PEP Classification Curriculum

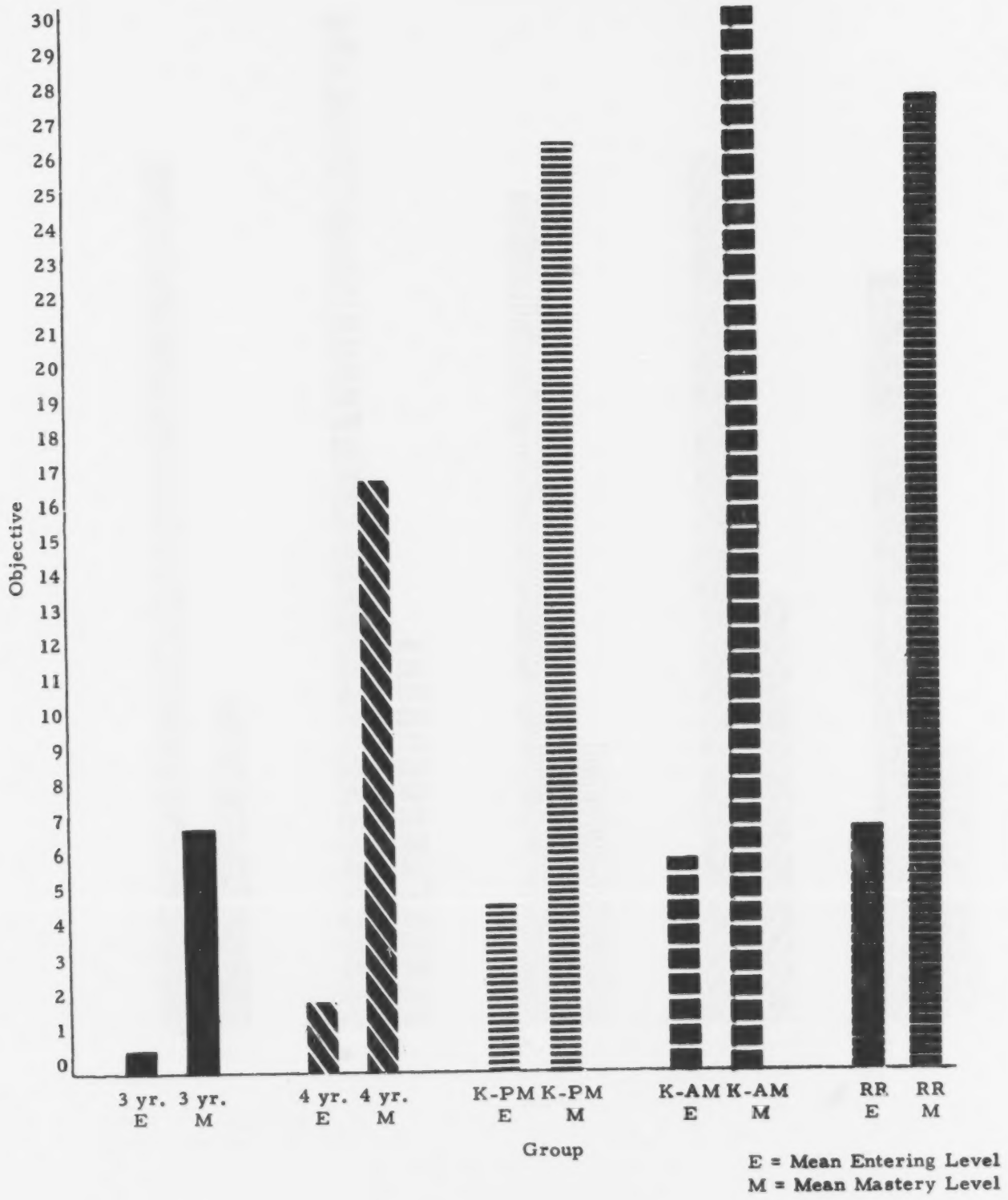


Figure 2. Student Progress in the PEP Quantification Curriculum

22

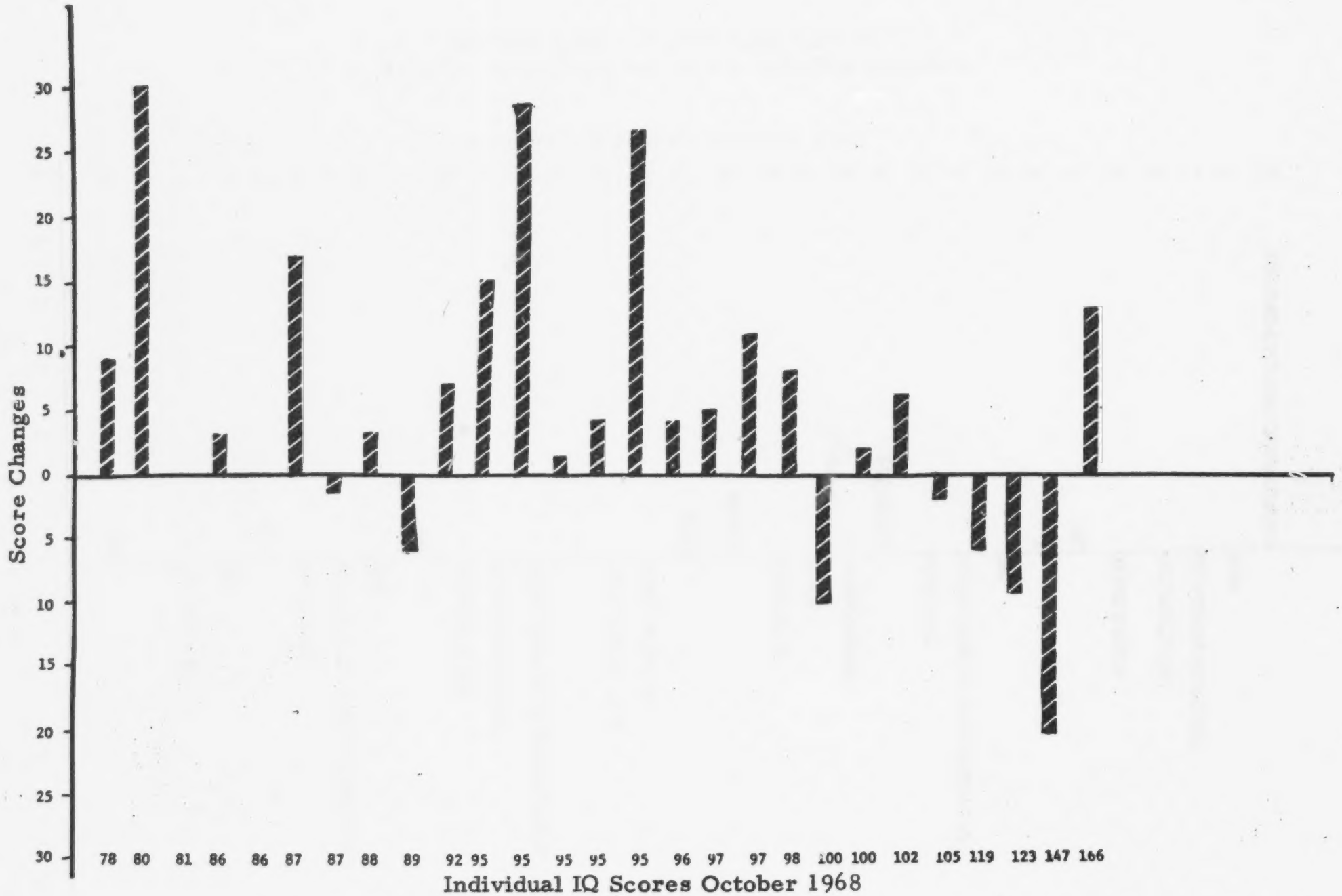


Figure 3. Stanford-Binet Score Changes Between October 1968 and May 1969 (Boys)

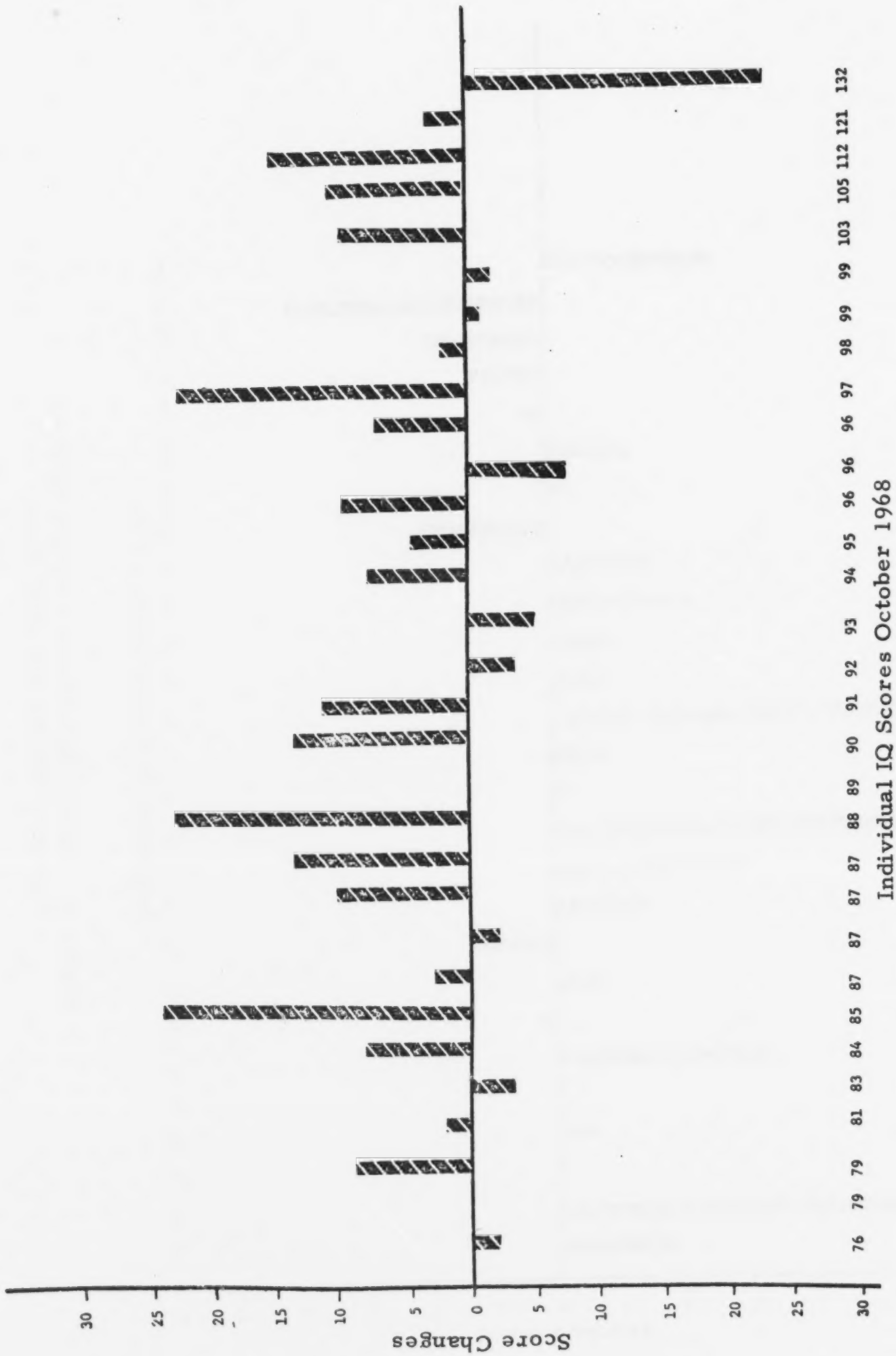
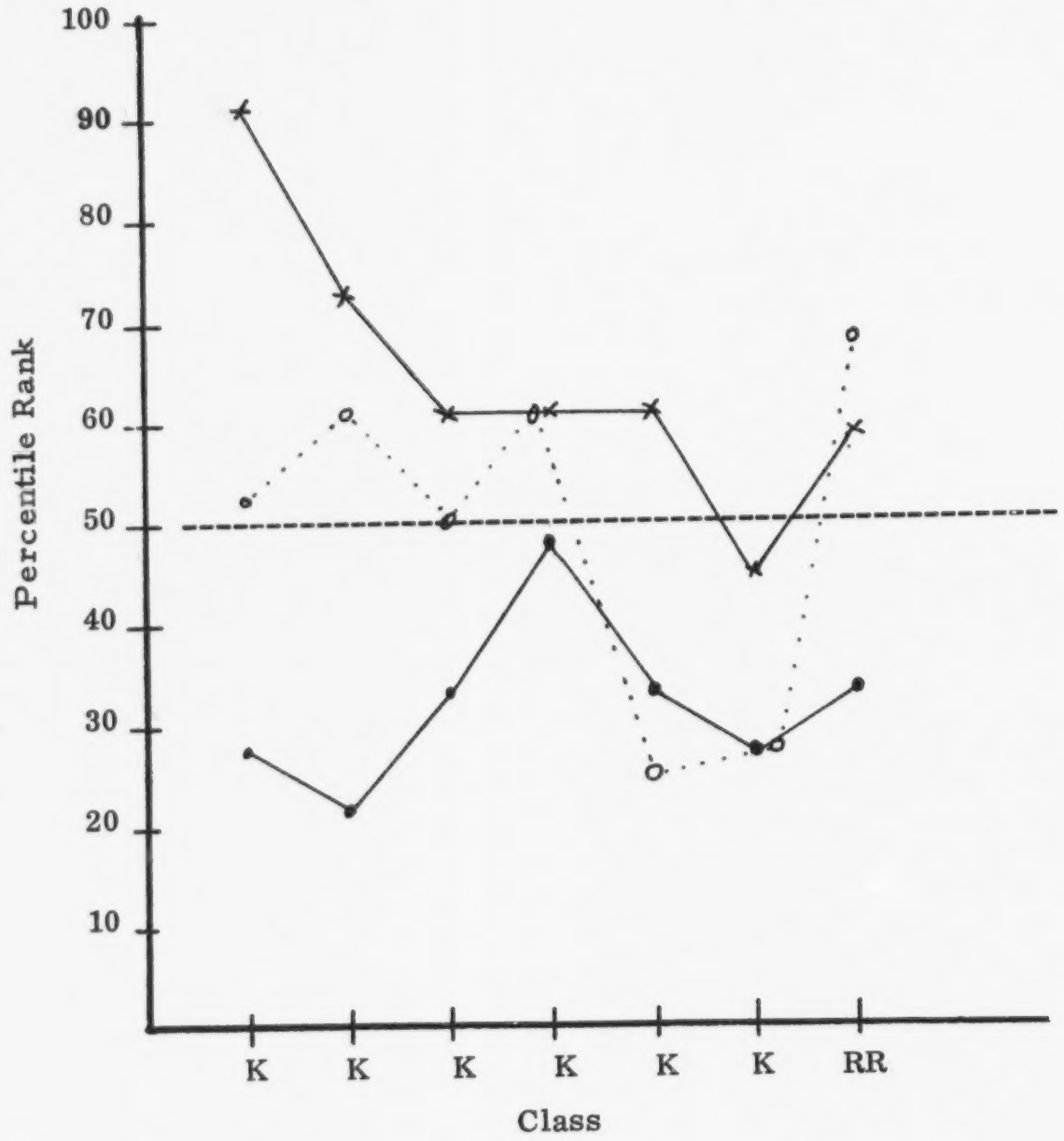


Figure 4. Stanford-Binet Score Changes Between October 1968 and May 1969 (Girls)



• Reading
x Arithmetic
o Spelling

Figure 5. Wide Range Achievement Test Results (Kindergarten and Reading Readiness Classes), May 1969

APPENDIX A

Objectives Included in the PEP Early Learning Curriculum

Beginning Mathematics Curriculum--1968-1969
Classification I Curriculum--1968-1969
General Motor Curriculum--1968-1969

Beginning Mathematics Curriculum
1968-1969

Unit	Basic Number Concept Skills		Basic Mathematic Operation	
	Topic	# of Objectives	Topic	# of Objectives
1	Object counting (1-5)	4	Temporal event counting (1-5)	4
	Numeral representation	5		
2	Object counting (6-10)	4	Temporal event counting (6-10)	4
	Numeral representation	5		
3			Counting skills (11-15)	6
			Numeral representation (11-15)	5
4			Counting skills (15-20)	6
			Numeral representation (15-20)	5
5			Counting skills (20-100)	11
			Numeral representation (20-100)	10
6			Counting skills (100-1000)	11
			Numeral representation (100-1000)	10
7	Comparison of sets	6	Addition (1-10)	5
			Subtraction (1-10)	4
			Ordinal numbers	2
Total		24		83

MEASUREMENT SKILLS

Weight	2
Length	7
Area	2
Volume	1
Total	12

Classification I Curriculum
1968-1969

Unit	Basic Discrimination Curriculum		Advanced Classification and Language Curriculum	
	Topic	# of Objectives	Topic	# of Objectives
1	Basic matching skills	3		
2	Basic color discrimination	12	Advanced color discrimination	3
3	Basic size discrimination	10	Size seriation	2
			Describing object size	2
			Advanced size discrimination skills	16
4	Basic shape discrimination	8	Advanced shape discrimination	22
5			Advanced classification skills	7
Total		33		52

General Motor Curriculum
1968-1969

Topic	# of Skills
Jumping	2
Hopping	4
Skipping	1
Walking	6
Balancing	8
Kicking	3
Throwing	4
Special topics	4
Total	32

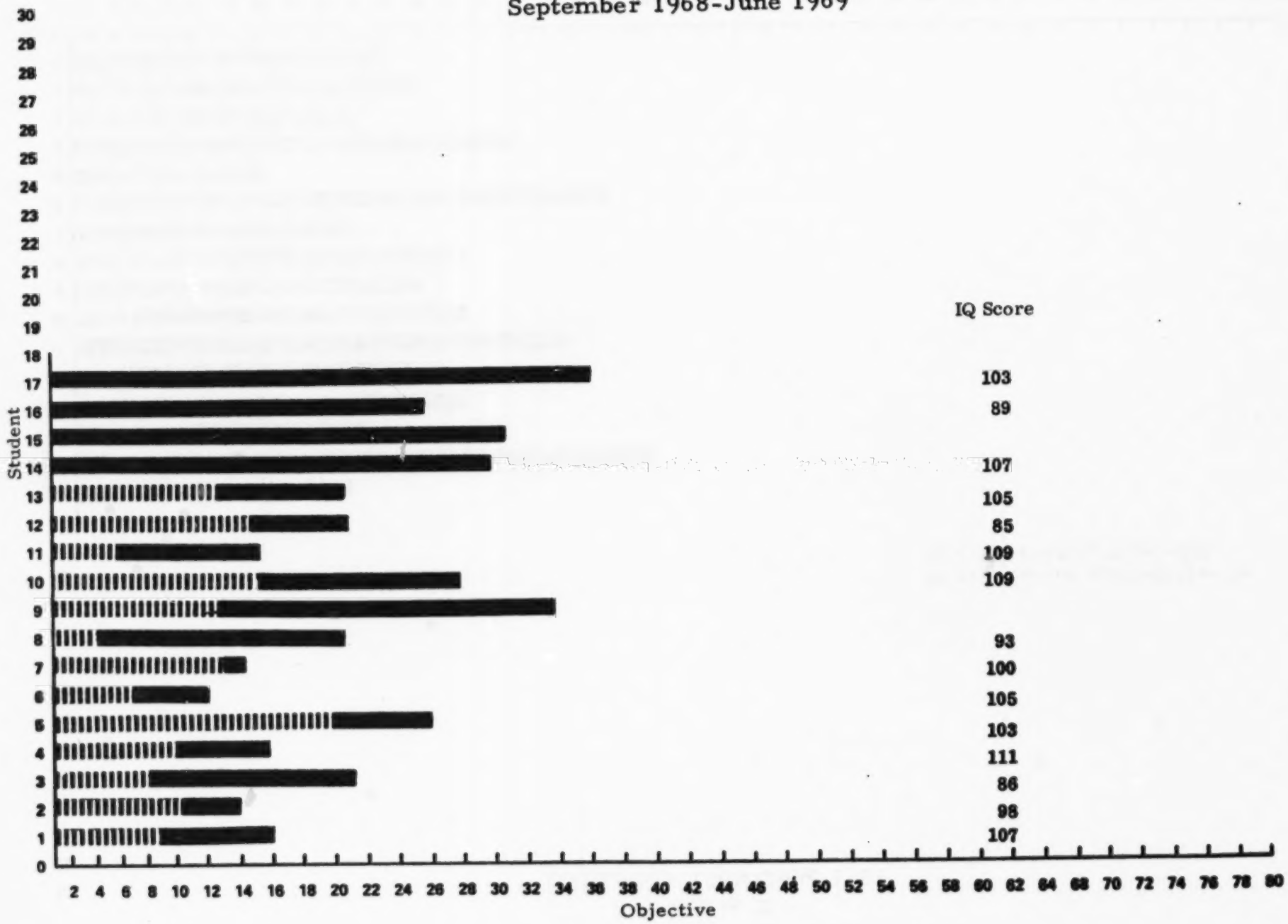
APPENDIX B

Samples of Student Progress Profile
Classification Curriculum

▮▮▮▮▮▮▮▮▮▮▮▮▮ = Entry Level

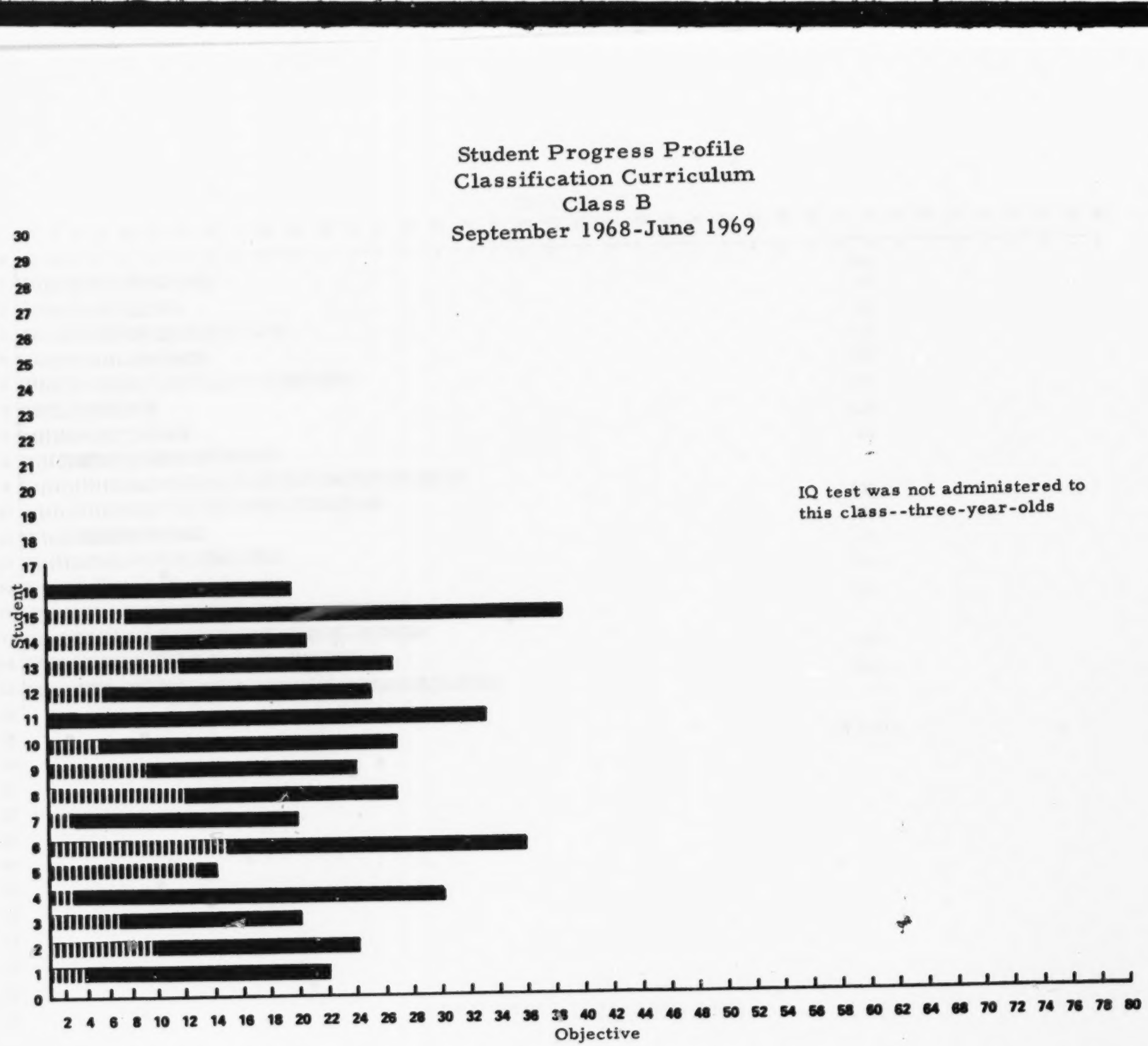
▬▬▬▬▬ = Mastery Level

Student Progress Profile
Classification Curriculum
Class A
September 1968-June 1969

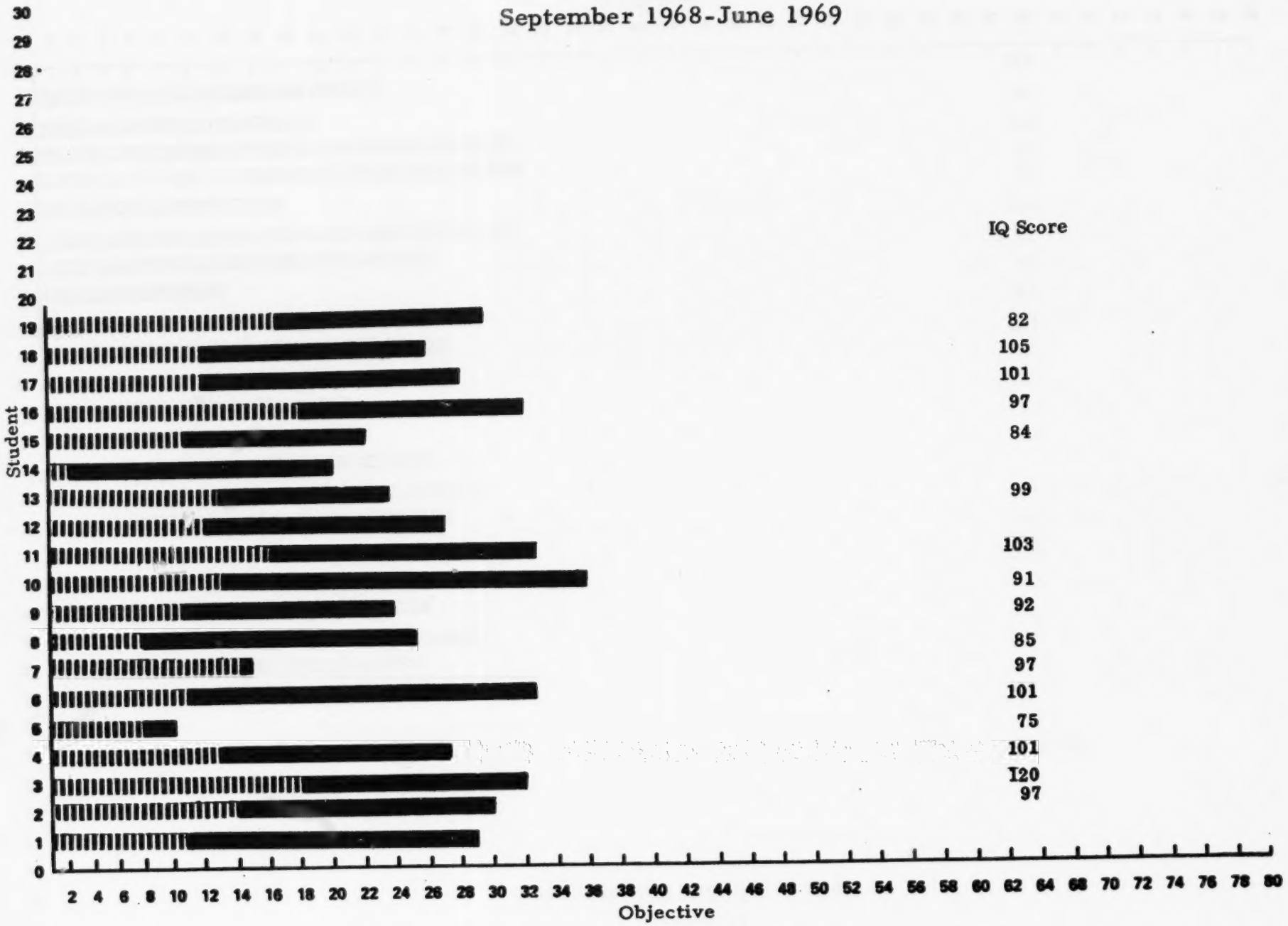


Student Progress Profile
Classification Curriculum
Class B
September 1968-June 1969

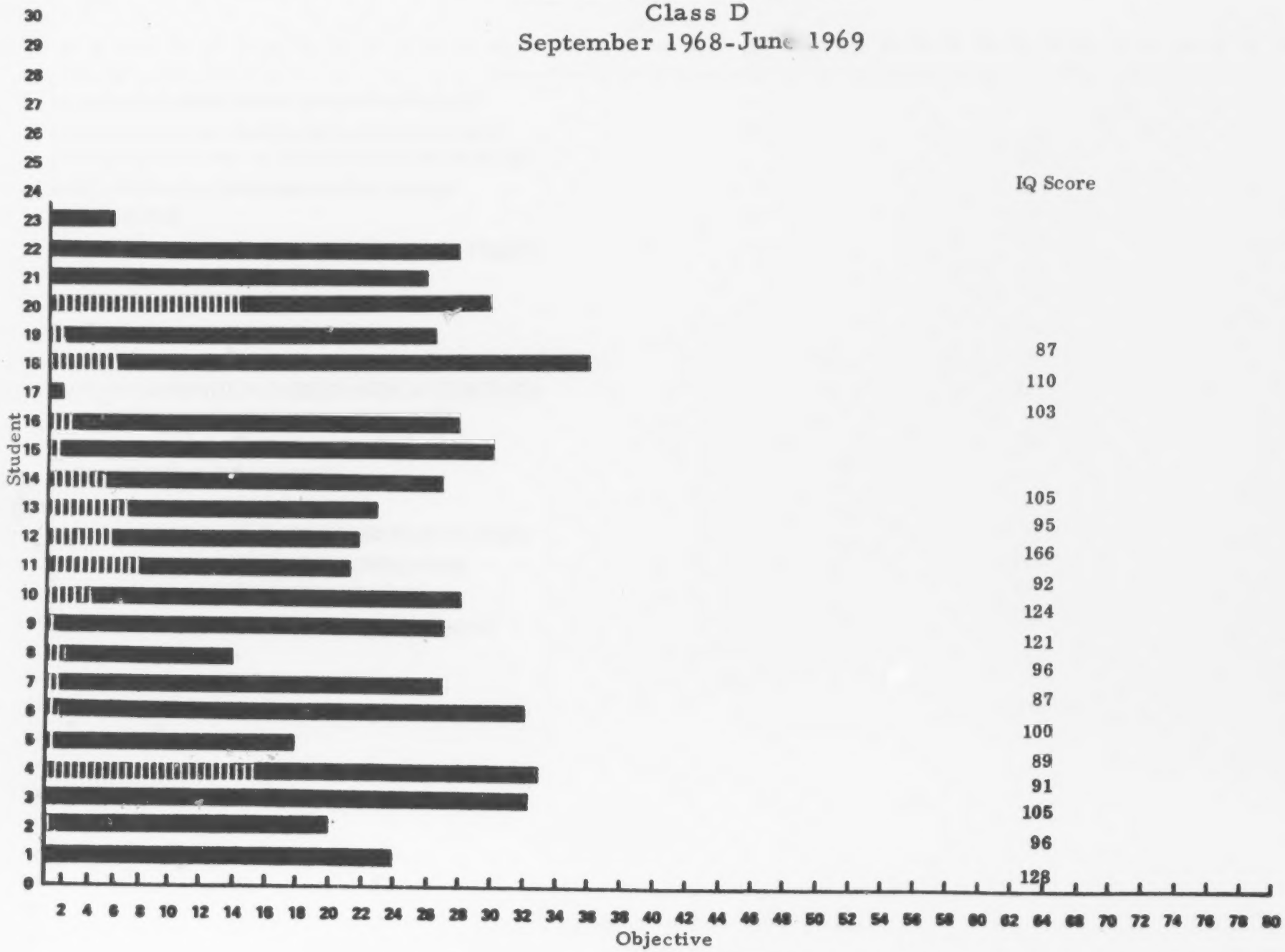
IQ test was not administered to this class--three-year-olds



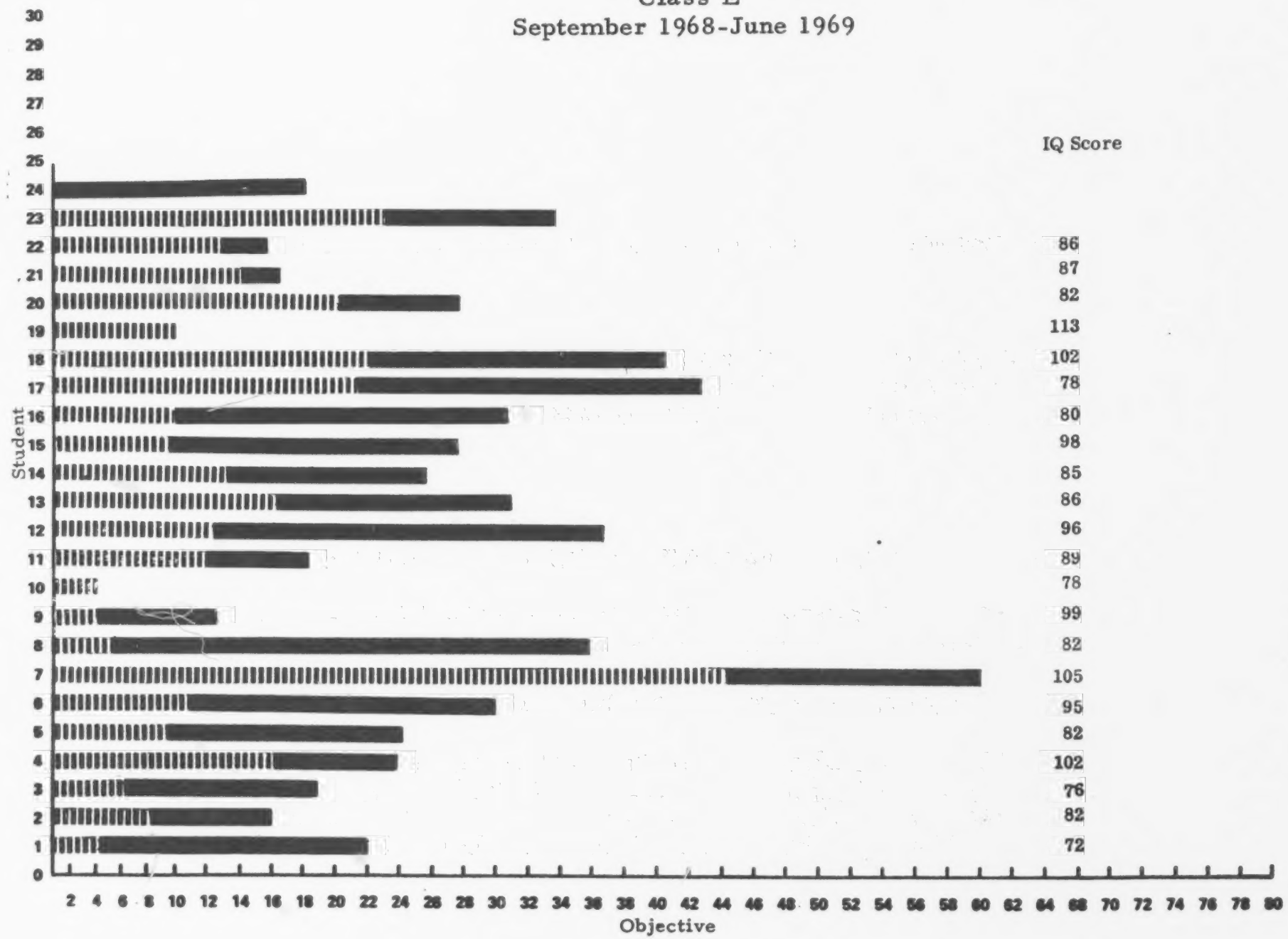
Student Progress Profile
Classification Curriculum
Class C
September 1968-June 1969



Student Progress Profile
Classification Curriculum
Class D
September 1968-June 1969



Student Progress Profile
Classification Curriculum
Class E
September 1968-June 1969



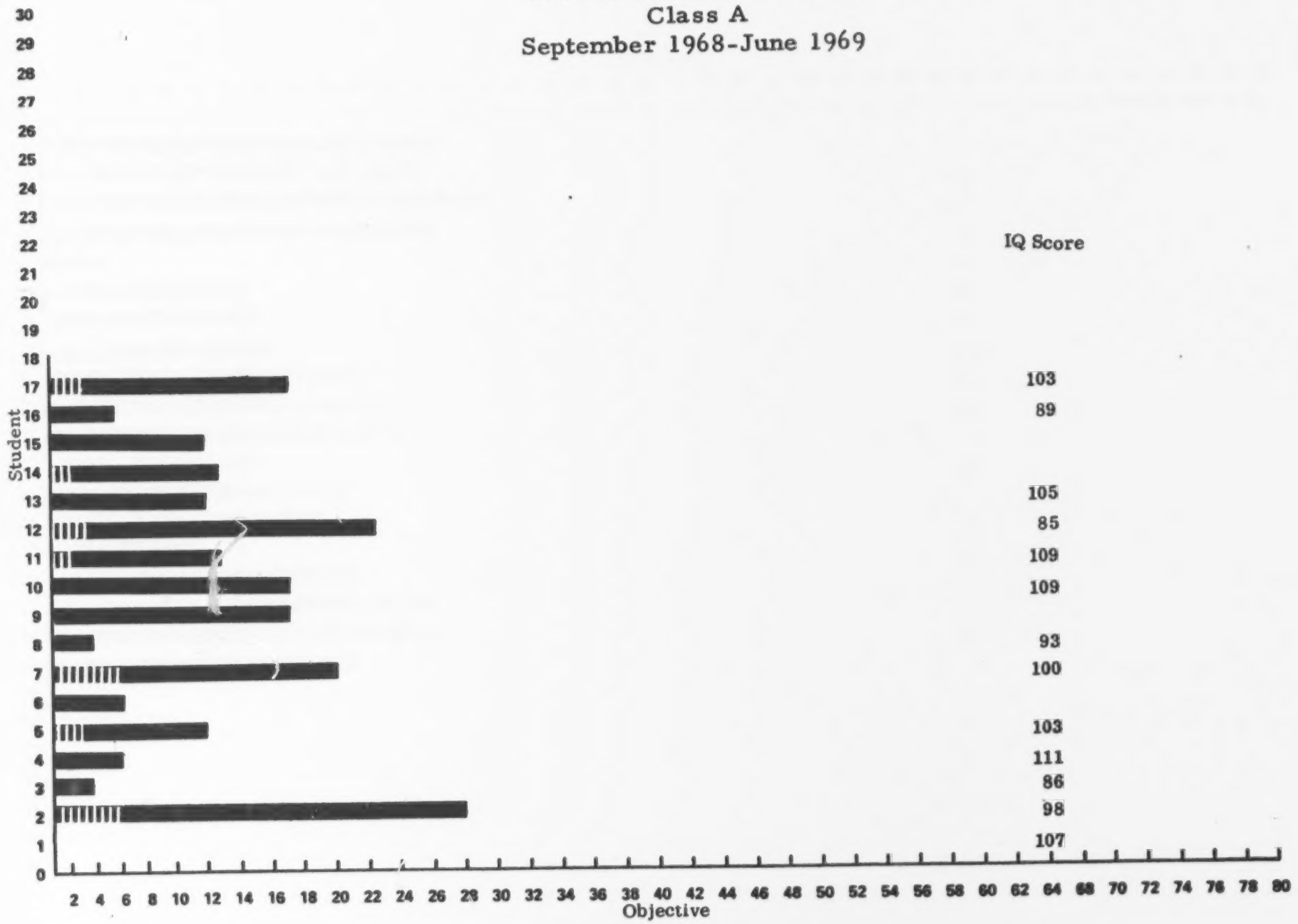
APPENDIX C

Samples of Student Progress Profile
Quantification Curriculum

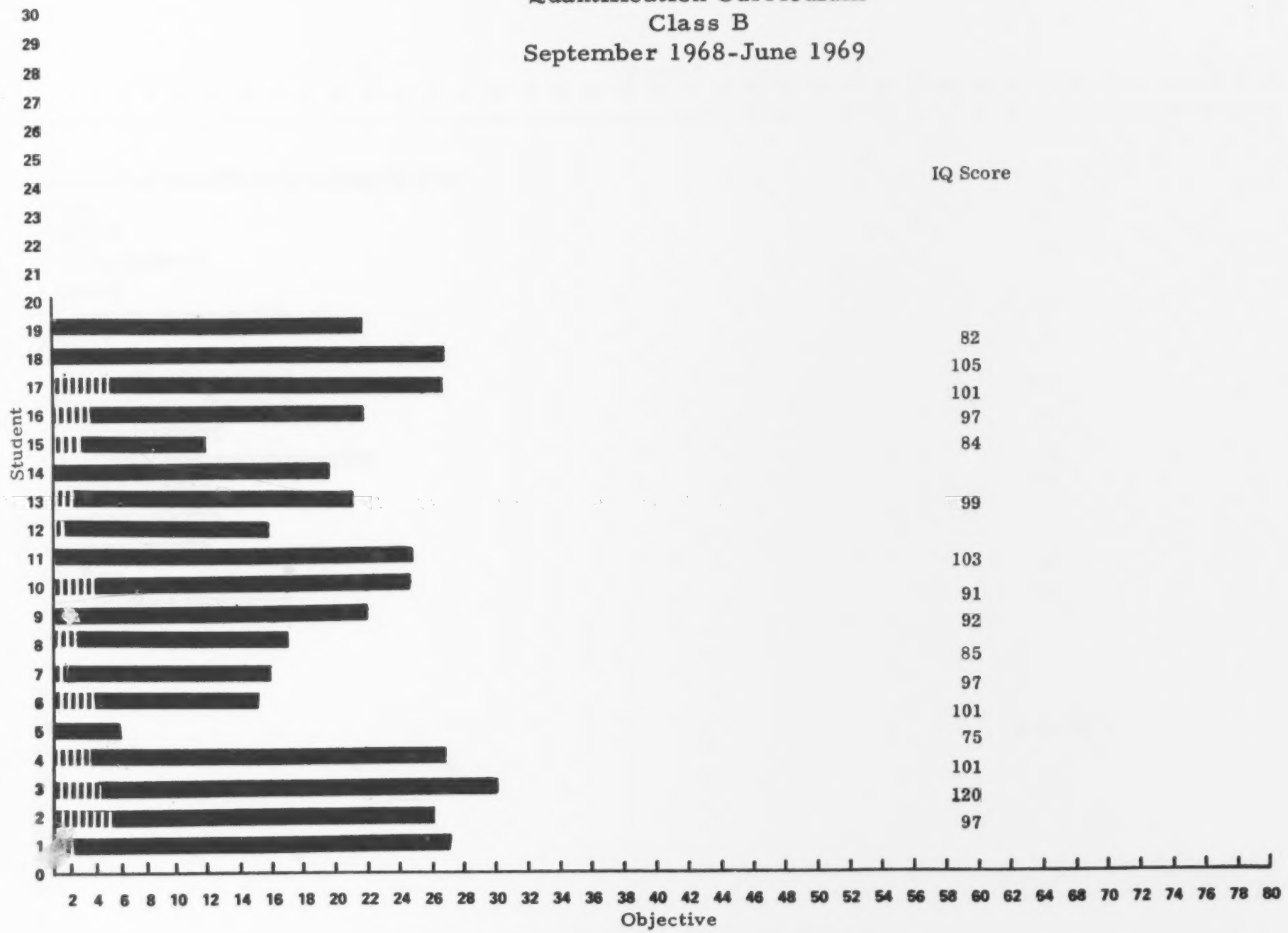
= Entry Level

= Mastery Level

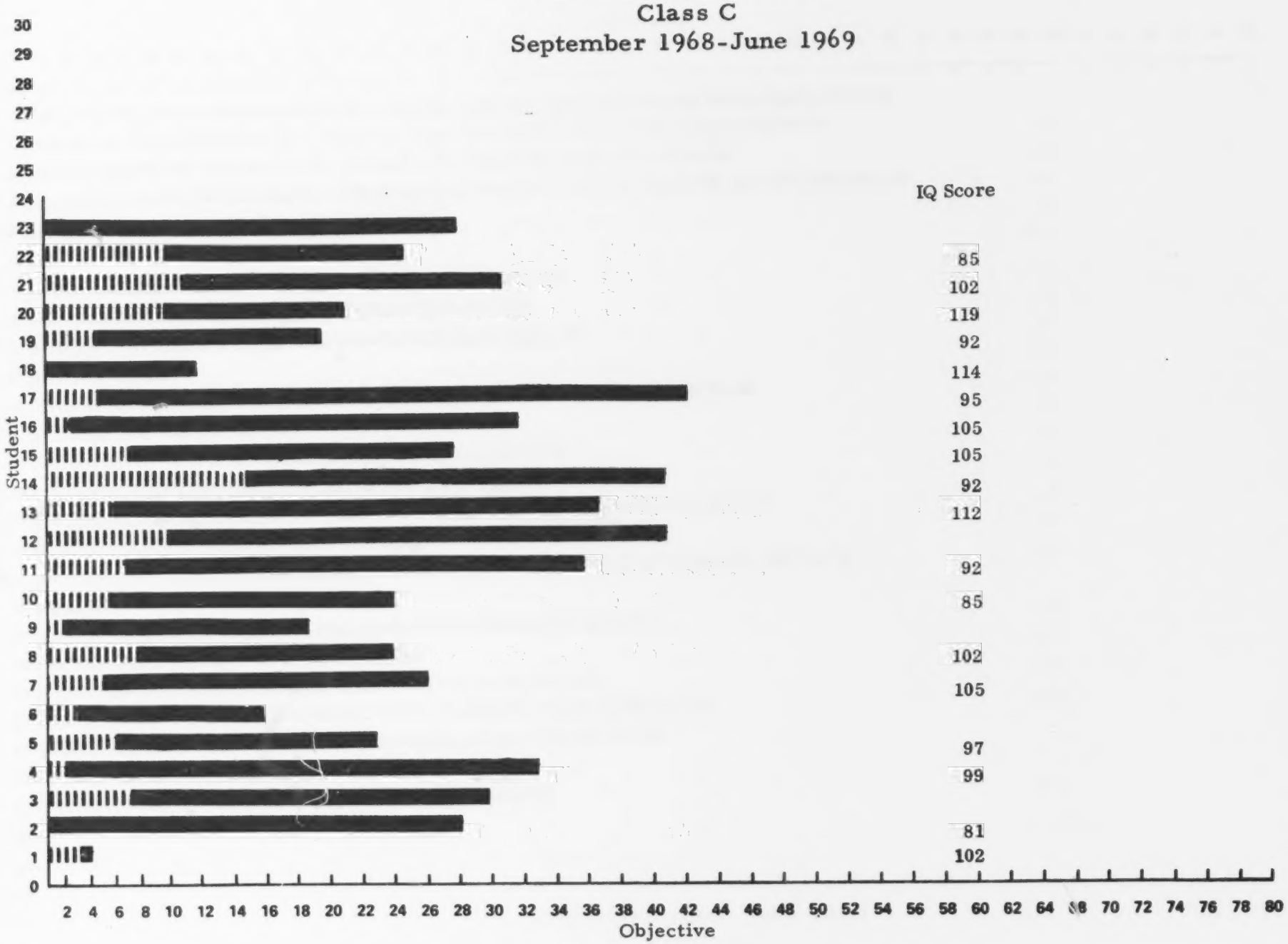
Student Progress Profile
Quantification Curriculum
Class A
September 1968-June 1969



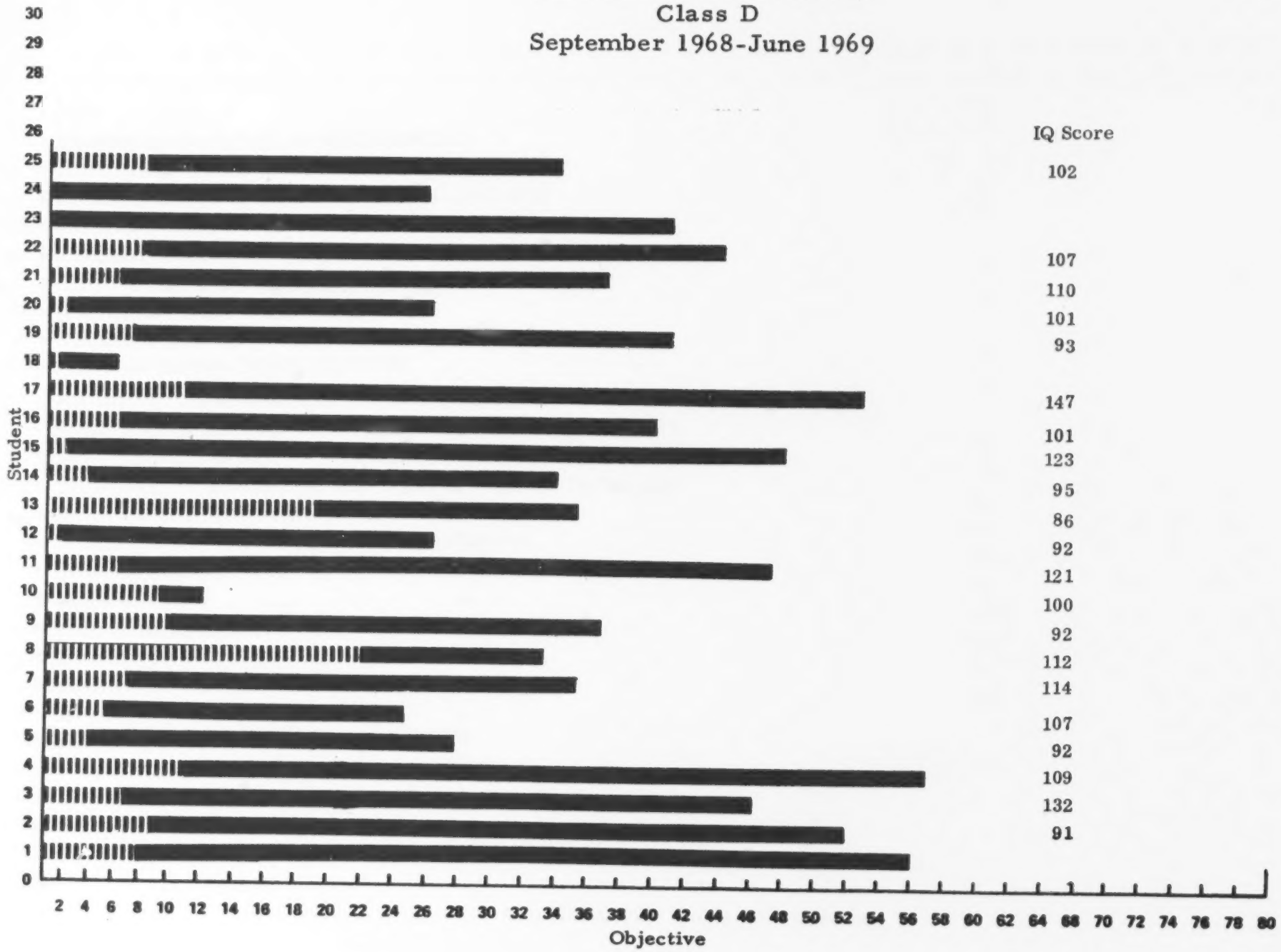
Student Progress Profile
Quantification Curriculum
Class B
September 1968-June 1969



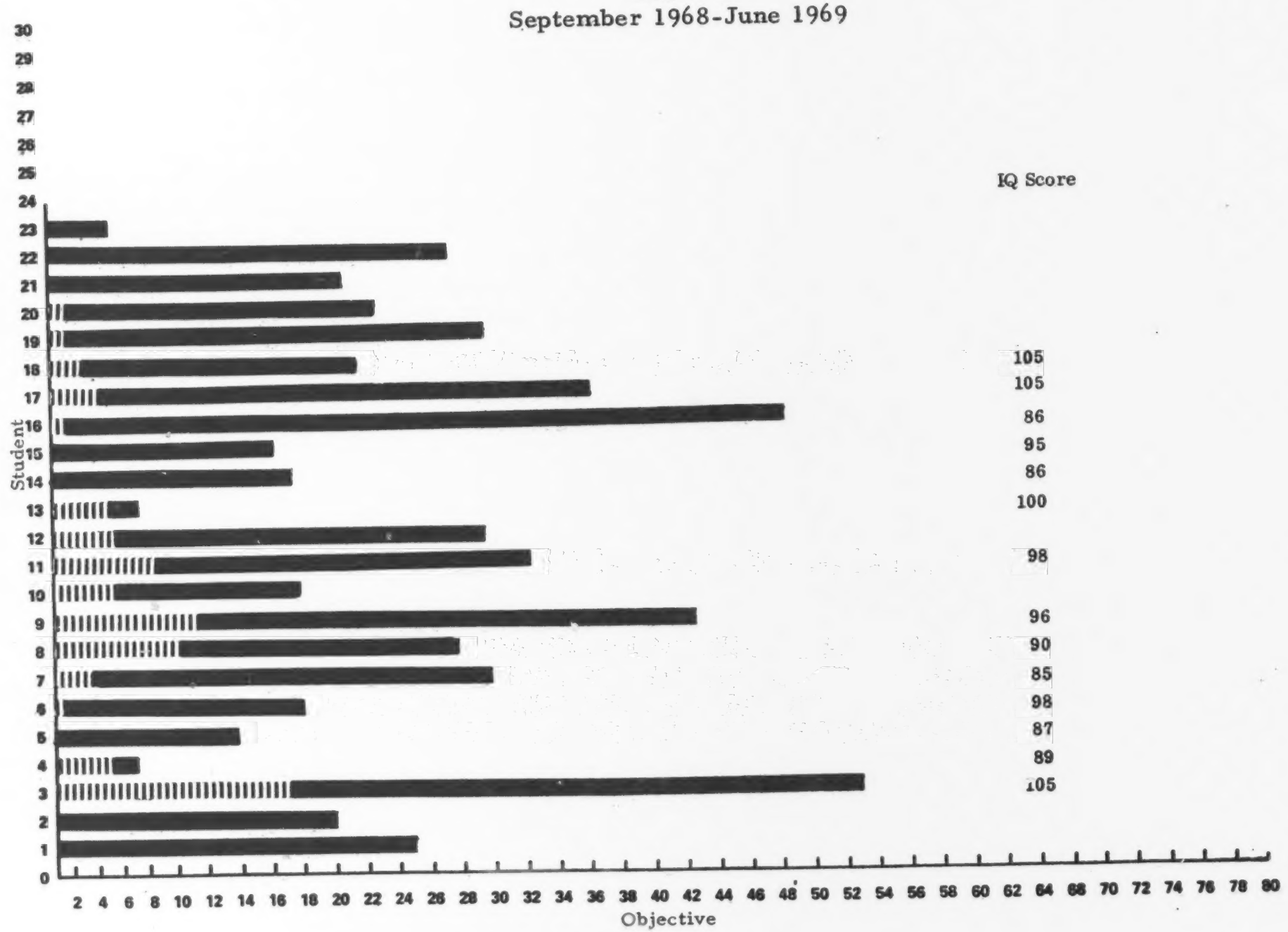
Student Progress Profile
Quantification Curriculum
Class C
September 1968-June 1969



Student Progress Profile
Quantification Curriculum
Class D
September 1968-June 1969



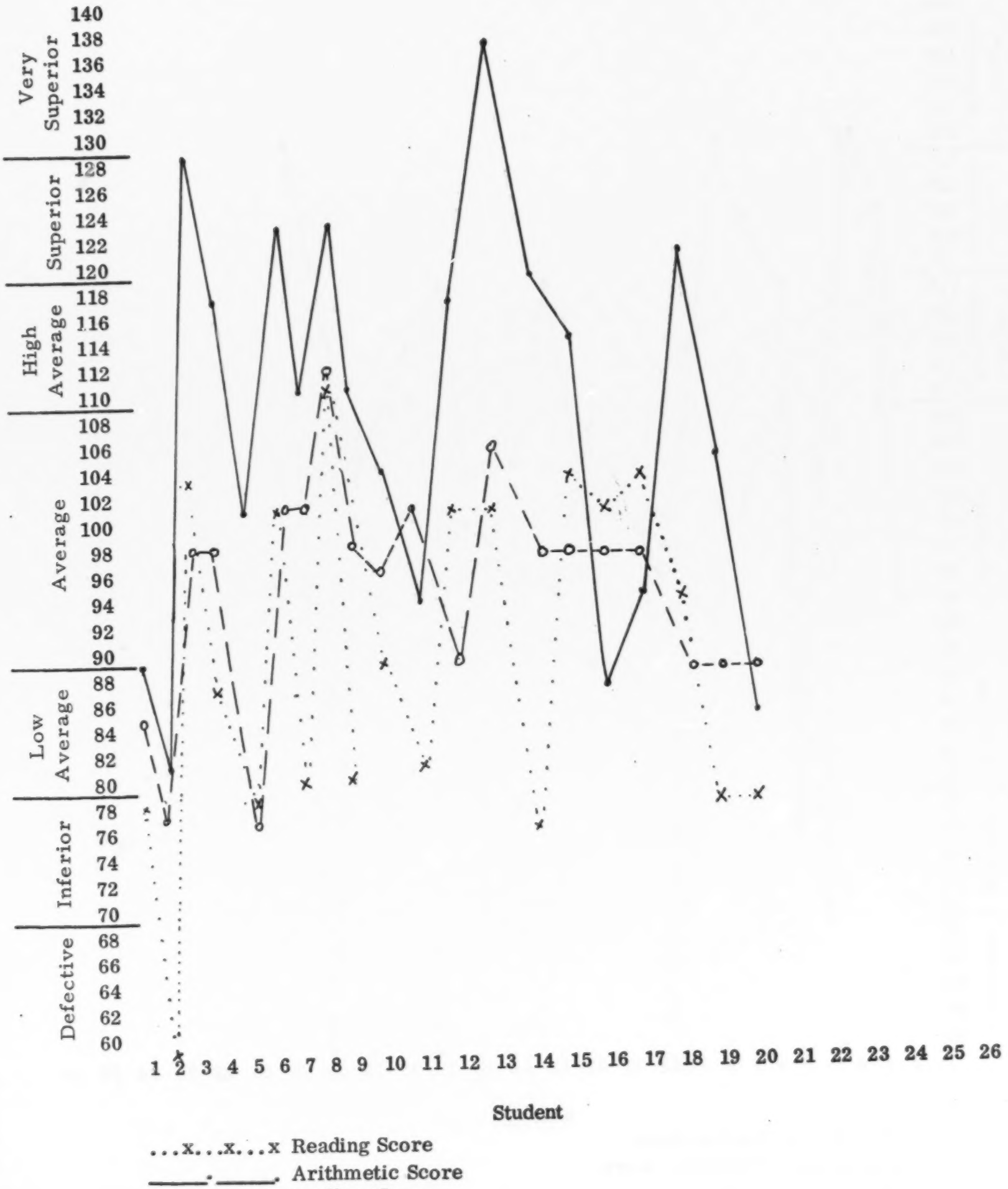
Student Progress Profile
Quantification Curriculum
Class E
September 1968-June 1969



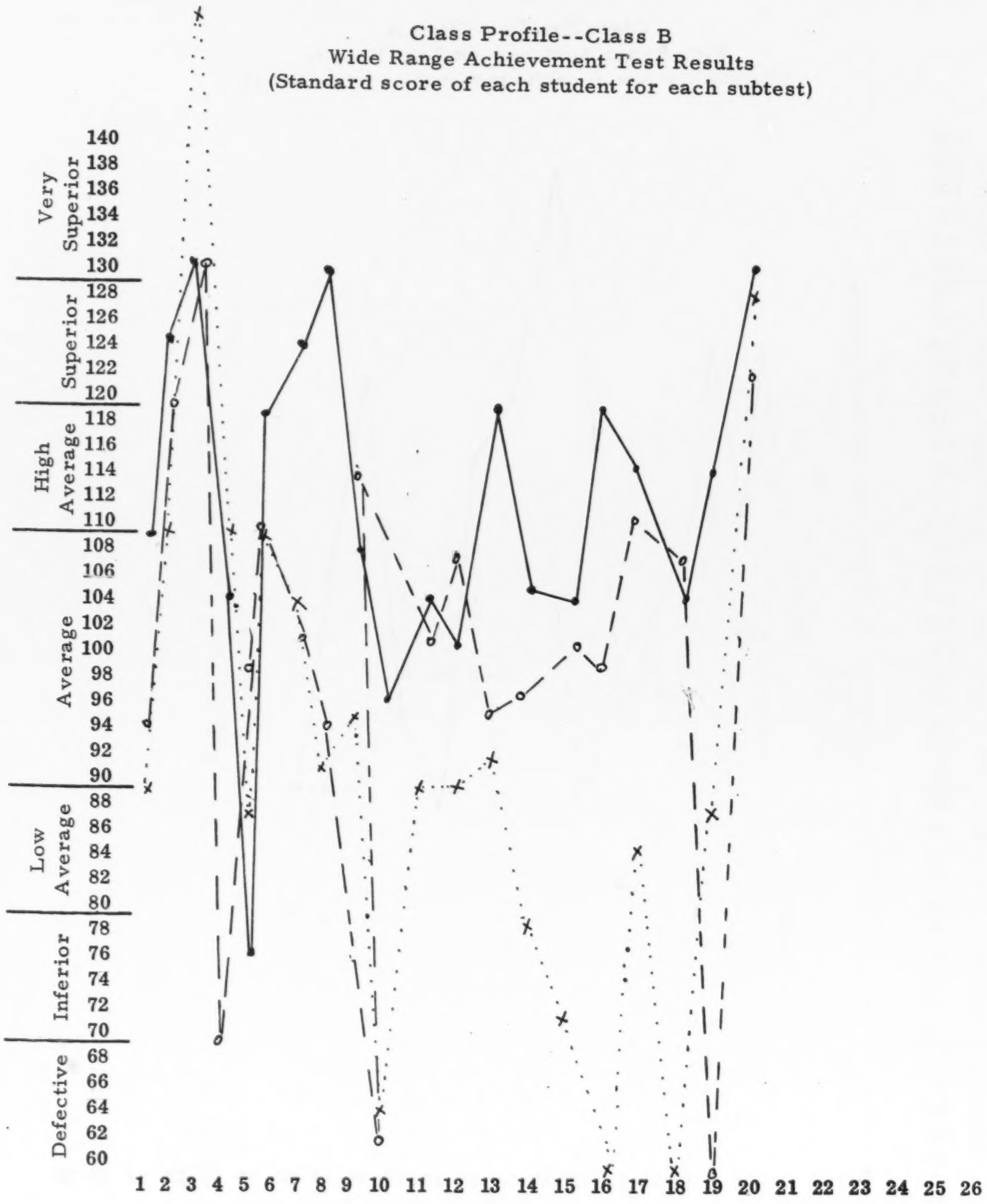
APPENDIX D

Class Profile
Wide Range Achievement Test Results
Classes A-F

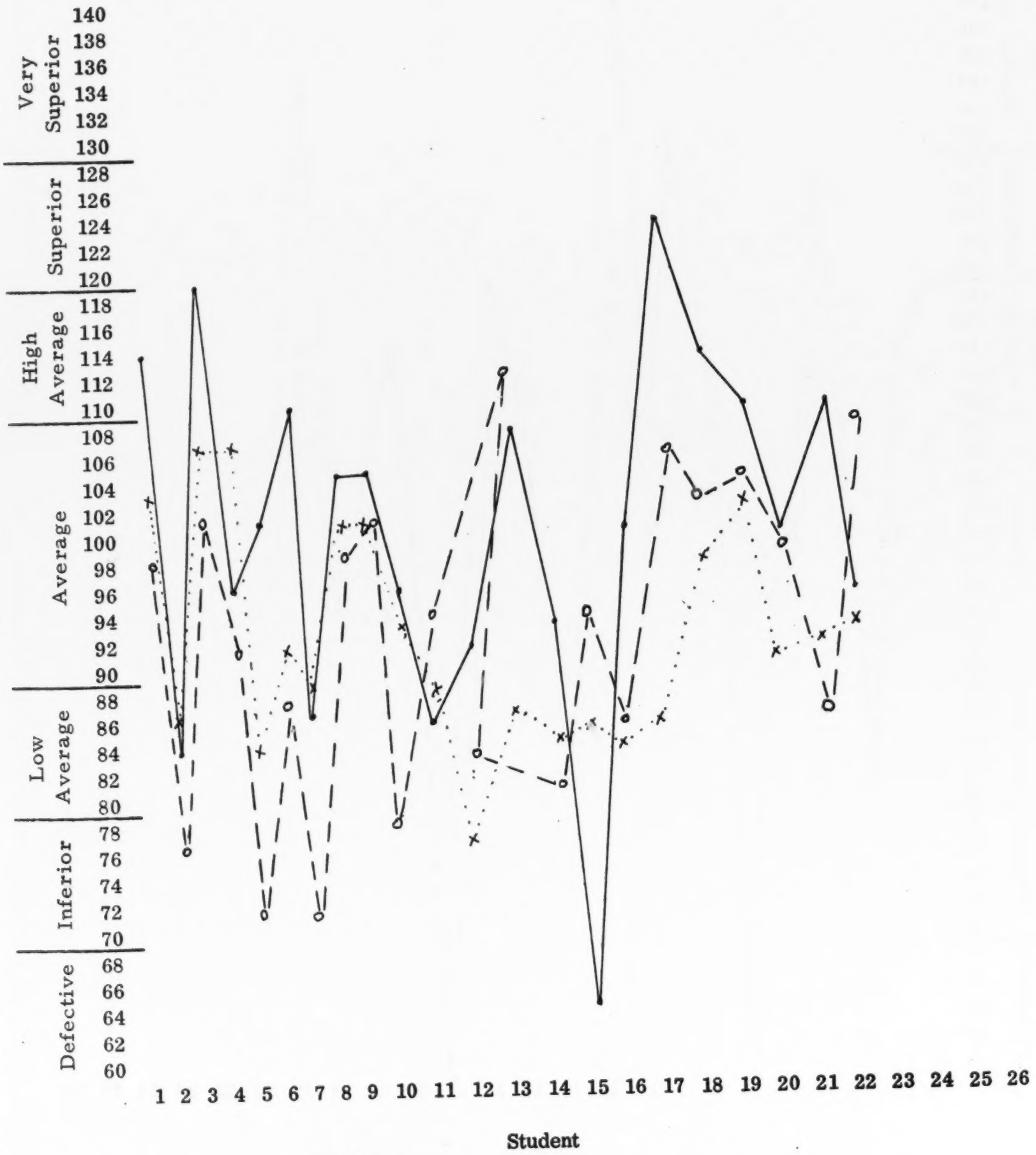
Class Profile--Class A
Wide Range Achievement Test Results
(Standard score of each student for each subtest)



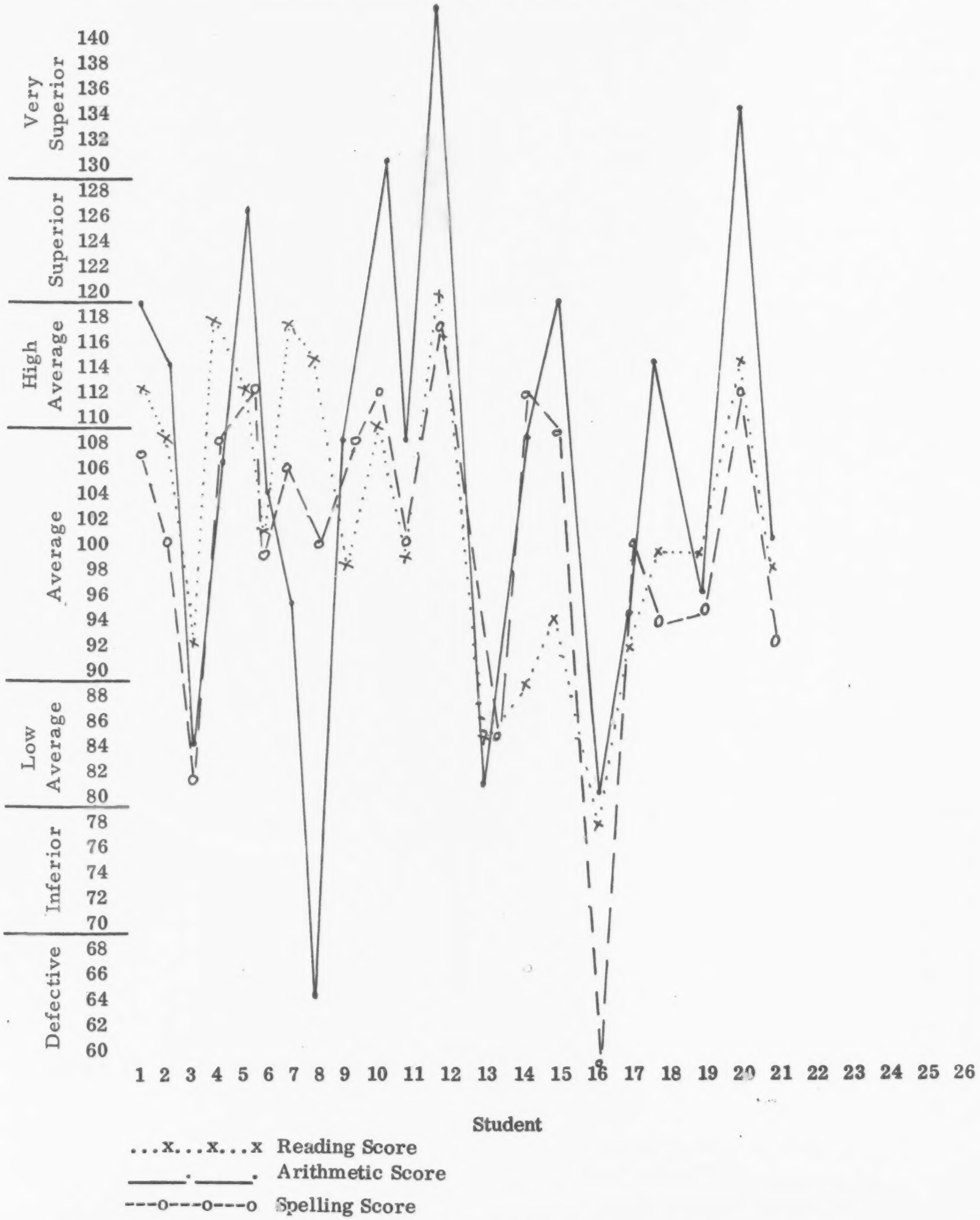
Class Profile--Class B
Wide Range Achievement Test Results
(Standard score of each student for each subtest)



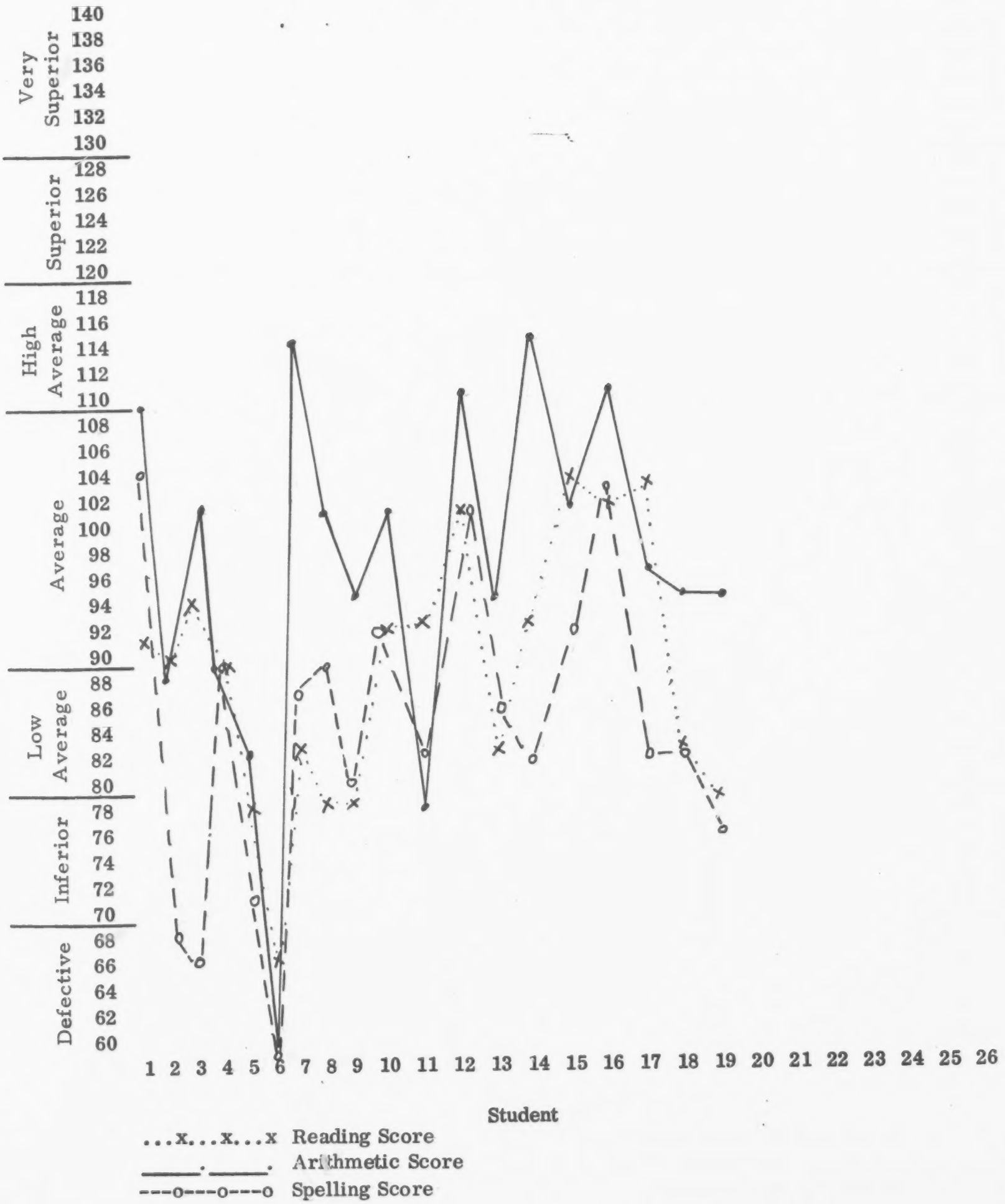
Class Profile--Class C
Wide Range Achievement Test Results
(Standard score of each student for each subtest)



Class Profile--Class D
Wide Range Achievement Test Results
(Standard score of each student for each subtest)



Class Profile--Class E
Wide Range Achievement Test Results
(Standard score of each student for each subtest)



Class Profile--Class F
Wide Range Achievement Test Results
(Standard score of each student for each subtest)